Remarks

I. Status of the Application

Following the Examiner's Office Action of June 13, 2007:

Claims 1, 3, and 8 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic (US 6,980,767, hereinafter Dujmenovic '767) in view of Wolkstein (US 5,222,246, hereinafter Wolkstein '246);

Claims 4-6 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic '767 and Wolkstein '246 in view of Satoh (US 6,983,129, hereinafter Satoh '129);

Claim 10 stands rejected under 35 USC § 103(a) as being unpatentable under 35 USC § 103(a) over Dujmenovic '767, Wolkstein '246 and Satoh '129 in view of Sanada (US 6,862,442, hereinafter Sanada '442);

Claims 7, 11, 13 and 21-22 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic '767 in view of Wolkstein '246 and Aggarwal (US 6,985,698, hereinafter Aggarwal '698);

Claims 14-18 and 20 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic '767, Wolkstein '246 and Aggarwal '698 in view of Satoh '129; and

Claim 23 stands rejected under 35 USC § 103(a) as being unpatentable over Aggarwal '698 in view of Wolkstein '246.

Independent claims 1, 11, and 23 are now amended. New claims 24-26 are added without the introduction of new matter.

With this amendment, 24 claims will be pending, one more than previously paid for. Applicant herewith supplies credit card authorization to pay the fees for the one additional dependent claim. Any additional charges are authorized to be debited from deposit account 50-3820.

Reconsideration of the pending claims 1, 3-11, and 13-26 in view of the foregoing amendments and following remarks is respectfully requested.

II. Claim Amendments

Claims 1, 11, and 23 are amended to recite the feature that the back termination couples to either the in-phase mixer port or the quadrature phase mixer port of the phase shift circuit. In particular embodiments, the in-phase or quadrature phase mixer port to which the termination port is coupled is either a single-ended signal port (as shown, e.g., in Fig. 3A) or a differential signal port, i.e., one of two ports that collectively form a differential signal line (as shown, e.g., Figs. 3B and 3C).

Claims 24-26 are added to recite an embodiment of the invention consistent with that shown in Fig. 3B. In particular, each claim recites the features that at least one of the in-phase or quadrature phase mixer ports are provided as differential signal ports, and that the back termination is coupled to one of the two differential signal ports. Support for this amendment is provided by Fig. 3B and the corresponding description thereof.

III. Rejection of the recited IQ Impedance-matched Network

Each of Independent claims 1, 11, and 23 recite an IQ Impedance-matched network, claim 11 reciting the network as a part of a larger image rejection circuit, and claim 23 reciting the network in means-plus-function form. Below, the Applicant addresses each the rejections of the IQ impedance-matched network as presented by the Examiner.

In the rejection of claim 1, the Examiner argues that the IQ impedance-matched network is disclosed by the combination of Dujmenovic '767 and Wolkstein '246 references (section 4 of the June 13, 2007 Office Action). In the rejection of claim 11, the Examiner argues the IQ impedance-matched network is disclosed by (i) the aforesaid combination of Dujmenovic '767 and Wolkstein '246 (section 7, paragraph 1 of the June 13, 2007 Office Action), and (ii) Aggarwal '698 (section 7, paragraph 4 of the June 13, 2007 Office Action). In the rejection of claim 23, the Examiner argues the IQ impedance-matched network is disclosed by the combination of Wolkstein '246 and Aggarwal '698. The Applicant submits that the recited impedance match network is allowable over each of these cited combinations, and addresses each basis below.

Rejection of Claim 1 based upon Dujmenovic '767 and Wolkstein '246

Claim 1 reciting the IQ impedance match network stands rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic '767 in view of Wolkstein '246.

Claim 1 recites:

"a phase shift circuit having an in-phase mixer port configured to receive the in-phase signal, a quadrature-phase mixer port configured to receive the quadrature-phase signal, a termination port, and an output port, the phase shift circuit configured to provide substantially a ±90 degree phase shift between the in-phase mixer and quadrature-phase mixer ports"

In section 4 of the June 13, 2007 Communication, the Examiner argued that Dujmenovic '767 discloses:

> "a phase shift circuit 38 having an in-phase mixer 30 port configured to receive the in-phase signal from amplifier 58, and a quadrature phase mixer 28 port configured to receive the quadrature phase signal from amplifier 58,"

these features illustrated in Fig. 2 of Dujmenovic '767. Upon review of these features, it can be seen that the 90-degree phase shift device 38 only includes one input port for receiving a quadrature phase signal; a second input port for receiving an in-phase signal is not disclosed. In particular, Dujmenovic '767 does not disclose or suggest a phase shift circuit which is operable to receive both I- and Q-phase signals. None of the remaining references discloses or suggests an IQ network incorporating a phase shift circuit that is operable to both receive I- and Q-phase signals.

Furthermore, Dujmenovic '767 does not disclose "a phase shift circuit having a termination port," as recited in claim 1. From the statement "Dujmenovic does not disclose a back termination coupled to the termination port of the phase shift circuit," it appears that the Examiner implies that Dujmenovic '767 discloses a termination port. The Applicant submits that the 90-degree phase shift device 38 of Dujmenovic '767 only includes an input port for receiving the Q-phase signal and an output port for providing a 90-degree phase shifted version of the input Q-phase signal. No termination port within the phase shift circuit 38 is disclosed or suggested in Dujmenovic '767. None of the remaining references discloses an IQ network incorporating a phase shift circuit having a termination port.

Accordingly, as neither Dujmenovic '767 nor any of the cited references discloses "a phase shift circuit configured to receive [an] in-phase signal [and] a quadrature-phase signal," and which further includes a termination port, claim 1 reciting said feature is

allowable thereover. Dependent claims 3-10 and 24 are allowable for at least the same reasons

No Motivation to Combine Dujmenovic '767 and Wolkstein '246

The Applicant additionally submits that the skilled person would not have been motivated to combine Dujmenovic '767 and Wolkstein '246 references to achieve the structure of the present invention.

Dujmenovic '767 discloses an image rejection mixer 24 for producing an I- and Q-phase signals. The image rejection mixer 24 functions similarly to a conventional image rejection mixer in which a 90-degree phase shifter 38 operates in one of the I- or Q- branches, illustrated in Fig. 2 as the Q-phase signal branch. The inventive aspect of Dujmenovic '767 appears to be directed to how the oscillator 11 and phase shift device 16 are implemented, Dujmenovic '767 proposing a ring oscillator 32 to produce the I- and Q-phase reference signals to respective I- and Q-phase mixers. In particular, the ring oscillator 32 employs cells 44_1-44_4, to provide an I-phase signal with a 90-degree delay to the I-phase mixer 30 relative to the Q-phase signal supplied to the Q-phase mixer 28. Other than an RF amplifier 58 which is used to adjust the level of the input signal supplied to the I- and Q-phase mixers and the aforementioned addition of the ring oscillator, the architecture of the image rejection circuit 24 is largely unchanged to the conventional circuit identified as prior art.

As observed above, the 90-degree phase shift device 38 of Dujmenovic '767 does not include a termination port. Absent such a termination port, the skilled person would not have been motivated to implement a back termination for otherwise coupling to the 90-degree phase shift device 38. Applicant can find no other motivation presented by Dujmenovic '767 as to why the skilled person would want or need to implement a back termination in the Dujmenovic '767 image rejection circuit 24. Absent any motivation to implement a back termination in Dujmenovic '767, the skilled person

would have had no motivation to implement the Wolkstein '246 structure, and accordingly, the cited references lack sufficient motivation to combine.

As Dujmenovic '767 does not disclose a back termination structure itself, this feature remains undisclosed from the cited art. Accordingly, claim 1 is allowable thereover. Independent claims 11 and 28 also recite a back termination, and each is accordingly allowable for at least the same reasons. Remaining dependent claims 2-10, 12-22 and 24-26 are allowable for at least the same reasons.

Rejection of Claim 11 based upon Aggarwal '698

Claim 11 reciting an image rejection circuit stands rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic '767 in view of Aggarwal '698, Aggarwal '698 being applied as disclosing the IQ impedance-matched network.

The IQ impedance-match network recited in claim 11 includes "a phase shift circuit" and "a back termination":

> "a phase shift circuit having an in-phase mixer port coupled to the in-phase mixer, a quadrature-phase mixer port coupled to the quadrature-phase mixer, a termination port, and an output port, the phase shift circuit configured to provide substantially a ±90 degree phase shift between the in-phase and quadrature-phase ports; and
>
> a back termination coupled to the termination port of the phase shift circuit, the back termination having an impedance value substantially equal to the characteristic impedance of the phase shift circuit at the termination port"

The Examiner cites feature 20 of Fig. 2 in Aggarwal '698 as disclosing the recited IQ impedance-matched network. Feature 20 refers to an impedance-matching network implementing inductors 23, 24 and capacitors 25, 26, 27 and 28. The values of these elements are selected such that network 20 passes a either PCS-band frequency via

capacitor pairs 25, 26 and 27, 28, or Cell-band frequencies via single capacitors 25 or 27 (Aggarwal '698, col. 3, line 67 to col. 4, line10).

The Applicant submits that the impedance-matching network 20 of Aggarwal '698 does not disclose or suggest a "phase shift circuit," as recited in claim 11. In particular, the impedance-matching circuit 20 maintains the phase relationship between the signals supplied from mixer 9 and mixer 10. No phase shifting of either set of signals is performed by the network 20 in Aggrawal '698. Furthermore, as the network 20 does not include a phase shifting circuit or equivalent means, the implementation of such a circuit with a termination port, as recited in claim 11, could not be said to have been obvious.

The network 20 of Aggarwal '698 also does not disclose the recited "back termination," and the Examiner (in paragraph 5, section 7 of the June 13, 2007 Communication) cites Wolkstein '246 to make up for this deficiency. However, as Aggrawal '698 does not disclose a termination port to which a back termination could be coupled, it is unclear what motivation the skilled person would have to attempt usage of a back termination with the Aggarwal '698 structure. From the Applicant's reading, Aggrawal '698 does not provide any suggestion, advantage or motivation to implement a back termination in the manner recited in claim 11. Therefore, apart from hindsight, there would have been insufficient motivation to combine Wolkstein '246 with Aggarwal '698 in the manner cited.

The Applicant observes that Fig. 1 of Aggrawal '698 describing a multi-band radio device 1 discloses phase shifter circuits 6 and 12, each operable to output a 0-degree and 90-degree version of their input signal. However, phase shifters 6 and 12 do not meet the requirement of possessing both an I-port and a Q-port for receiving respective I and Q signals, or possessing a termination port, as recited in claim 11.

For the foregoing reasons, the IQ impedance-matched network of claim 11 is not disclosed or suggested by the references cited, and accordingly, claim 11 is allowable thereover. Remaining dependent claims 13-22 and 25 are allowable for at least the same reasons.

Rejection of Claim 23 based upon Aggrawal '698 and Wolkstein '246

Claim 23 reciting an IQ impedance-matched network stands rejected under 35 USC § 103(a) as being unpatentable over Aggrawal '698 in view of Wolkstein '246.

Claim 23 recites:

> "phase shifting means having an in-phase mixer port configured to receive the in-phase signal, a quadrature-phase mixer port configured to receive the quadrature phase signal, a termination port, and an output port, the phase shifting means configured to provide substantially a ±90 degree phase shift between the in-phase and quadrature-phase mixer ports; and
>
> termination means coupled to the termination port of the phase shifting means, the termination means having an impedance value substantially equal to the characteristic impedance of the phase shifting means at the termination port"

Aggrawal '698 is argued as disclosing all of the above-recited features, with the exception of the termination means coupled to a termination port, this feature argued as disclosed by Wolkstein '246. In particular, the recited IQ network is argued as disclosed by the network 20, and phase shifters 6 and 12 are argued as the recited "phase shifting means." The Applicant notes that the phase shifters 6 and 12 are implemented outside of the network 20, and thus are not included within that circuit, as required by claim 23. As the network 20 does not itself include any phase shifting means, this requirement is not meet by Aggrawal '698.

Further missing from Aggrawal '698 is the disclosure or suggestion to implement a termination port within a phase shifting means, the phase shifting means disposed within the impedance matched network 20. As no phase shift means is implemented within network 20, it would not have been obvious to implement a termination port within the omitted phase shifting means.

The Examiner observes that Aggrawal '698 also does not disclose the recited "termination means," and the Examiner (in paragraph 3, section 9 of the June 13, 2007 Communication) cites Wolkstein '246 to make up for this deficiency. However, as Aggrawal '698 does not disclose a phase sifting means with a termination port to which the termination means could be coupled, it is unclear what motivation the skilled person would have to attempt usage of a termination means with the Aggrawal '698 structure. From the Applicant's reading, Aggrawal '698 does not provide any suggestion, advantage, or motivation to implement a back termination in the manner recited in claim 11. Accordingly, apart from hindsight, there would have been insufficient motivation to combine Wolkstein '246 with Aggrawal '698 in the manner cited.

For the foregoing reasons, the IQ impedance-matched network of claim 23 is not disclosed or suggested by the references cited, and accordingly, claim 23 is allowable thereover. Remaining dependent claim 26 is allowable for at least the same reasons.

Conclusion

The Applicant submits that the pending claims 1, 3-11, and 13-26 are allowable over the prior art, and accordingly requests the issuance of a Notice of Allowance in due course. Should the Examiner believe an interview would expedite prosecution of the case, a telephone call or e-mail to the Applicants' representative indicating a day and time most convenient for the Examiner would be welcomed.

Respectfully submitted,

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